What is claimed is:

1. An optical multi-layer system on a crystalline substrate, obtainable by

a) applying a free-flowing composition comprising nanoscale inorganic solid particles having polymerizable and/or polycondensable organic groups to a crystalline substrate;

b) polymerizing and/or polycondensing the groups of the solid particles to form an organically crosslinked layer;

c) applying a further composition according to a), which gives rise to a different refractive index than the preceding composition, to the organically crosslinked layer;

d) polymerizing and/or polycondensing the groups of the solid particles to form a further organically crosslinked layer;

e) optional single or multiple repetition of steps c) and d) to form further organically crosslinked layers on the organically crosslinked layers already present and/or other surfaces of the substrate; and

f) single-stage thermal consolidation of the layer composite and burnout of the organic constituents present;

for the layer applied last,

1) optionally, the polymerization and/or polycondensation of the groups of the solid particles to form an organically crosslinked layer can also be effected directly in the final stage f) or

2) optionally and alternatively, the nanoscale inorganic solid particles have no polymerizable and/or polycondensable organic groups, so that, in this case, for the uppermost layer, no polymerization and/or polycondensation of groups of the solid particles with formation of organic crosslinking takes place before or in step f).

2. The optical multi-layer system as claimed in claim 1, characterized in that the crystalline substrate is composed of silicon, lithium niobate, lithium tantalate, quartz, sapphire, other precious stones or semi-precious stones, PbS or selenium.

3. The optical multi-layer system as claimed in claim 1 or claim 2, characterized in that the crystalline substrate is planar or curved.

4. The optical multi-layer system as claimed in one of claims 1 to 3, characterized in that the substrate is transparent.

5. The optical multi-layer system as claimed in one of claims 1 to 4, characterized in that the substrate is provided on both sides with an optical multi-layer system.

6. The optical multi-layer system as claimed in one of claims 1 to 5, characterized in that the crystalline substrate is a sheet, especially of sapphire, a watchglass, especially of sapphire, an instrument cover glass, a wafer, especially of silicon, a crystalline detector or an optical filter.

7. A process for producing an optical multi-layer system on a crystalline substrate, characterized by the following stages:

a) applying a free-flowing composition comprising nanoscale inorganic solid particles having polymerizable and/or polycondensable organic groups to a crystalline substrate;

b) polymerizing and/or polycondensing the groups of the solid particles to form an organically crosslinked layer;

c) applying a further composition according to a), which gives rise to a different refractive index than the preceding composition, to the organically crosslinked layer;

d) polymerizing and/or polycondensing the groups of the solid particles to form a further organically crosslinked layer;

e) optional single or multiple repetition of steps c) and d) to form further organically crosslinked layers on the organically crosslinked layers already present and/or other surfaces of the substrate; and

f) single-stage thermal consolidation of the layer composite and burnout of the organic constituents present;

for the layer applied last,

1) optionally, the polymerization and/or polycondensation of the groups of the solid particles to form an organically crosslinked layer can also be effected directly in the final stage f) or

2) optionally and alternatively, the nanoscale inorganic solid particles have no polymerizable and/or polycondensable organic groups, so that, in this case, for the uppermost layer, no polymerization and/or polycondensation of groups of the solid

particles with formation of organic crosslinking takes place before or in step f).

8. The process according to claim 7, characterized in that the formation of the optically crosslinked layer(s) is carried out at temperatures up to about 150°C, preferably up to about 130°C.

9. The process as claimed in any one of claims 7 and 8, characterized in that the formation of the organically crosslinked layer(s) is effected by photochemical polymerization and/or polycondensation.

10. The process as claimed in any one of claims 7 to 9, characterized in that the one-stage consolidation and burnout is effected at temperatures in the range of 400-800°C, preferably 400-600°C.

11. The process as claimed in any one of claims 7 to 10, characterized in that the one-stage consolidation and burnout is carried out in such a way that heating of the layer composite is effected from the outside inward in the direction toward the substrate.

12. The process as claimed in claim 11, characterized in that the heating rate of the layer(s) is at least 100°K/min.

13. The process as claimed in any one of claims 7 to 12, characterized in that the nanoscale particles are selected from semimetal and metal compounds, especially oxides, sulfides, selenides and tellurides of semimetals or metals and mixtures thereof.

14. The process as claimed in any one of claims 7 to 13, characterized in that the nanoscale particles are selected from those of SiO_2, TiO_2, ZrO_2, ZnO, Ta_2O_5, SnO_2 and Al_2O_3 and mixtures thereof.

15. The process as claimed in any one of claims 7 to 14, characterized in that the polymerizable and/or polycondensable surface groups are selected from organic radicals which possess a (meth)acryloyl, vinyl, allyl or expoxy group.

16. The process as claimed in any one of claims 7 to 15, characterized in that the solid particles used have been produced by surface modification of nanoscale solid particles having the appropriate surface groups.

17. The process as claimed in any one of claims 7 to 16, characterized in that the solid particles used have been produced using at least one compound having appropriate polymerizable/polycondensable groups.

18. The process as claimed in any one of claims 7 to 17, characterized in that the inorganic solid particles are produced by the sol-gel process.

19. The process as claimed in any one of claims 7 to 18, characterized in that the coating composition has a pH in the range from 3 to 8.

20. The use of the optical multi-layer system as claimed in one of claims 1 to 6 as an interference layer system and especially as an antireflection layer system.